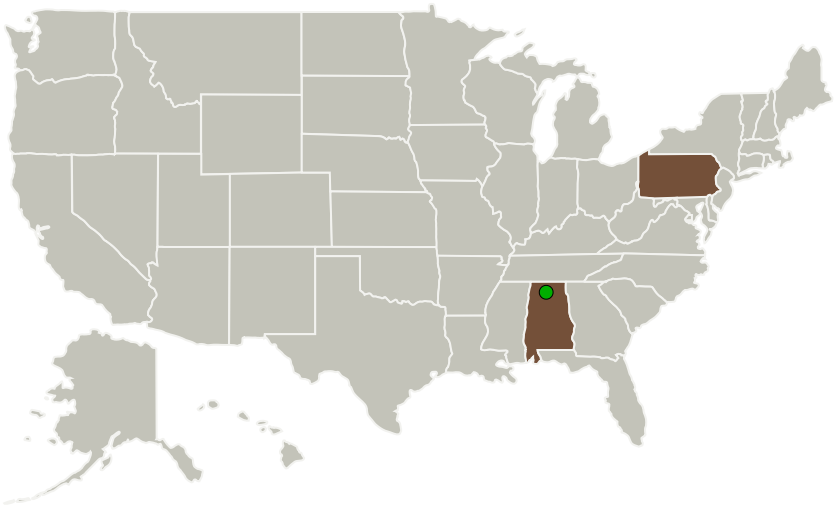
Hybrid Heat Pipes for High Heat Flux Applications, Phase I

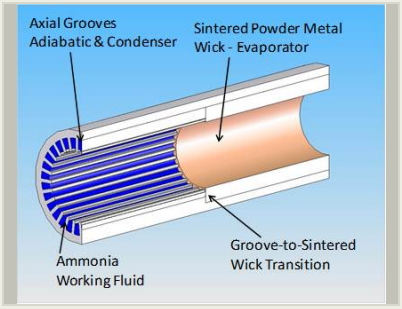
Completed Technology Project (2014 - 2014)

Project Introduction

The thermal transport requirements for future spacecraft missions continue to increase, approaching several kilowatts. At the same time the heat acquisition areas have trended downward, thereby increasing the incident heat flux. Current incident heat flux for laser diode applications is on the order of 5-10W/cm2, although this is expected to increase towards 50W/cm2. This is a severe limitation for axial groove aluminum/ammonia constant conductance heat pipes (CCHPs). The maximum heat flux in a CCHP is set by the boiling limit, which typically start at 5 W/cm2 for axial grove wicks, and 20-30 W/cm2 for powder metal wicks. The innovation is to develop CCHPs with either a sintered wick, or a hybrid grooved and sintered wick. A hybrid grooved and sintered wick CCHP will allow operating at higher heat fluxes as compared to axial groove design and can also operate against gravity on the planetary surface, operate in space, carrying power over long distances, act as a thermosyphon on the planetary surface for Lunar and Martian landers and rovers, and demonstrate a higher transport capability than an all-sintered wick.

Primary U.S. Work Locations and Key Partners





Hybrid Heat Pipes for High Heat Flux Applications Project Image

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Organizations Performing Work	Role	Type	Location
Advanced Cooling Technologies, Inc.	Lead Organization	Industry	Lancaster, Pennsylvania
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Pennsylvania

Project Transitions

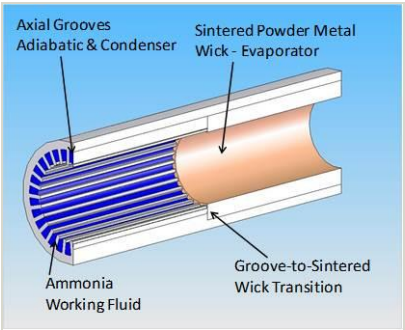
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140601)*

Images



Project Image
Hybrid Heat Pipes for High Heat Flux Applications Project Image *(https://techport.nasa.gov/image/125751)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Advanced Cooling Technologies, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

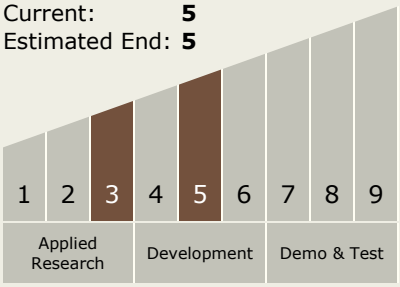
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Mohammed Ababneh

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.2 Heat Transport

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System